Clean Coal Diesel Demonstration Project

Participant
Arthur D. Little, Inc. (ADL)

Additional Team Members
University of Alaska at Fairbanks—host and cofunder
Fairbanks Morse Engine, Goodrich Corp.—diesel engine technology vendor
Usibelli Coal Mine, Inc.—coal supplier

Location
Fairbanks, AK (University of Alaska facility)

Technology
Fairbanks Morse coal-fueled diesel engine

Plant Capacity/Production
6.4 MWe (net)

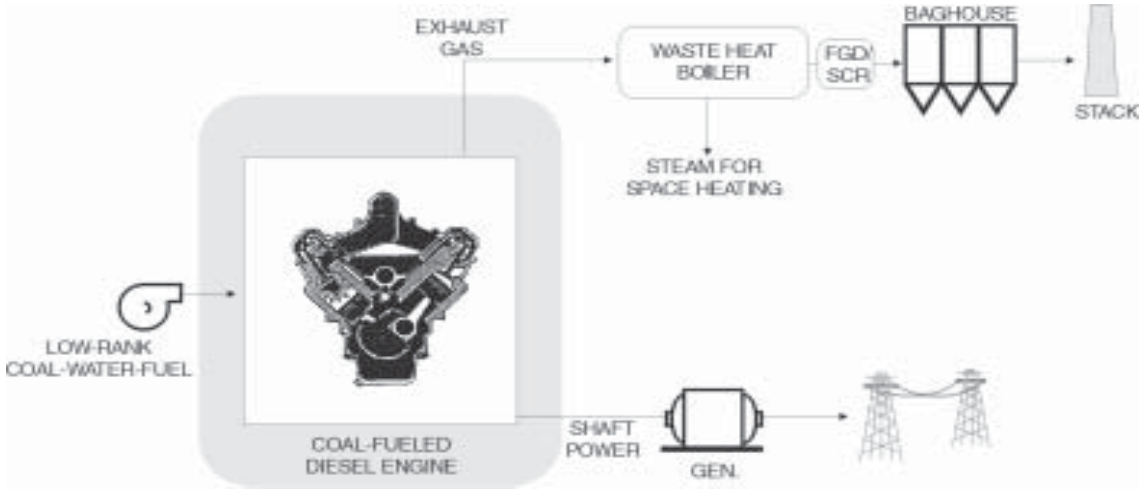
Coal
Usibelli Alaskan subbituminous

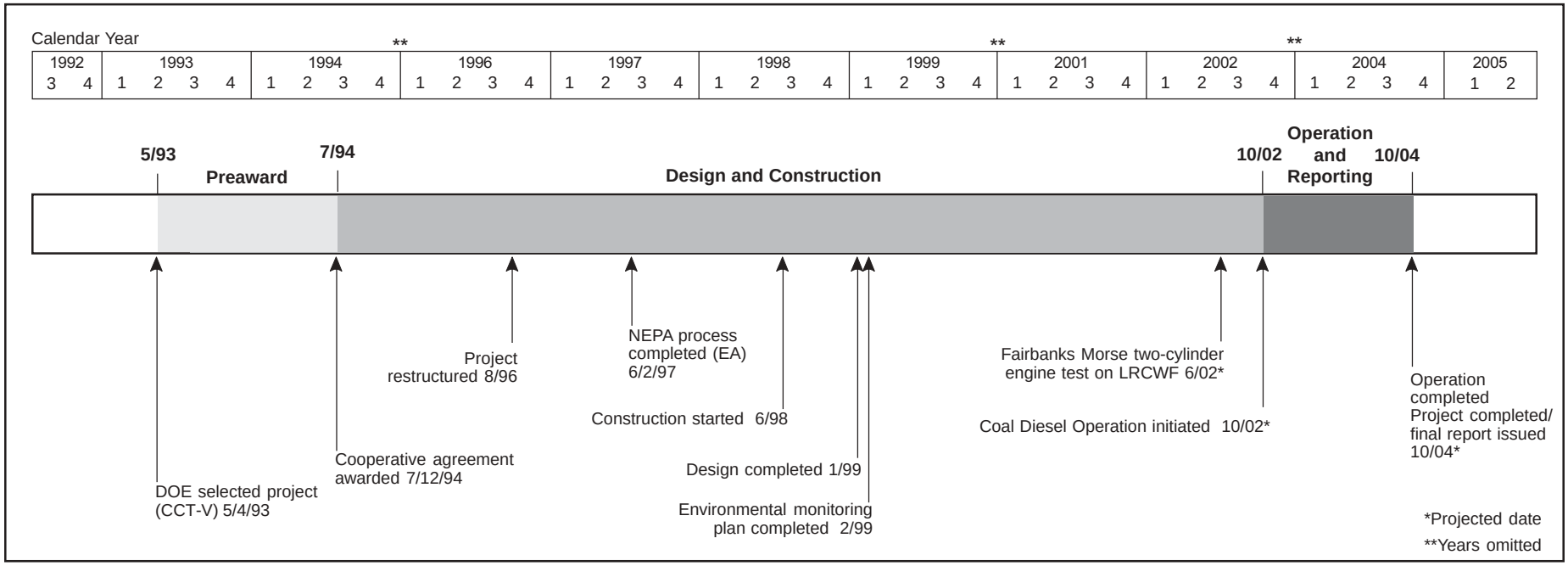
Project Funding

Total project cost	$47,636,000	100%
DOE	23,818,000	50
Participant	23,818,000	50

Project Objective
To prove the design, operability, and durability of the coal diesel engine during 4,000 hours of operation and test the coal slurry in the diesel.

Technology/Project Description
The project is based on the demonstration of an 18-cylinder, heavy-duty engine (6.4 MWe) modified to operate on Alaskan subbituminous coal. The clean coal diesel technology, which uses a low-rank coal-water-fuel (LRCWF), is expected to have very low NO_x and SO_2 emission levels (50–70% below current New Source Performance Standards). In addition, the demonstration plant is expected to achieve 41% efficiency, and future plant designs are expected to reach 48% efficiency. This will result in a 25% reduction in CO_2 emissions compared with conventional coal-fired plants. The engine will use selective catalytic reduction (SCR) for NO_x control.





Project Status/Accomplishments

Overall project system design was completed in early 1999. The 18-cylinder diesel engine arrived on site at UAF in January 1999 and was mounted in the engine house in late February. In October 1999, the engine, after being connected to the generator, was operated on diesel fuel to ensure it would function coupled with the generator. In May 2000, total system startup was attempted on diesel fuel. The SCR system for the diesel was tested in August 2000 and achieved 90% reduction in NO_x emissions, which was within contract specifications. Since August 15, 2000, the diesel has been supplying all of the university's power requirements on fuel oil. Upon completion of system checkout, the diesel engine will be modified to use the LRCWF. Manufacture of the hardened engine parts for the Fairbanks Morse two-cylinder test engine, coal fuel preparation and testing, and completion of the baghouse and SNCR system are in progress.

With the change of site from Easton, Maryland to UAF, Alaskan subbituminous coal will now be used to manufacture the LRCWF. Usibelli Coal Mine, Inc. will supply the coal. Samples of three different blends of LRCWF have been formulated and sent to Fairbanks Morse for testing in a fuel injector test rig. As of September 30, 2001, the testing was in progress. The latest additive has proven to be effective. Tests related to long-term reliability related to clogging or damaging the needle point and for pressure regulation of the fuel pumping system are being conducted. The goal of the testing is to determine which blend has the best fluid properties and to reduce clogging at the fuel tips. Tests on the Fairbanks Morse two-cylinder test engine will provide information and data on how to optimize the operational settings, verify the coal fuel performance, and finalize the requirements for hardened coatings for critical components.

Commercial Applications

The U.S. diesel market is projected to exceed 60,000 MWe (over 7,000 engines) through 2020. The worldwide market is 70 times the U.S. market. The technology is particularly applicable to distributed power generation in the 5- to 20-MWe range, using indigenous coal in developing countries.

The net effective heat rate for the mature diesel system is expected to be 6,830 Btu/kWh (48%), which makes it very competitive with similarly sized coal- and fuel oil-fired installations. Environmental emissions from commercial diesel systems should be reduced to levels between 50% and 70% below NSPS. The estimated installation cost of a mature commercial unit is approximately $1,300/kW.